PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.: 10/811,161

Filing Date: March 26, 2004

Appellant: Manish Sinha

Group Art Unit: 1795

Examiner: Keith D. Walker

Title: LOAD FOLLOWING ALGORITHM FOR A FUEL CELL BASED DISTRIBUTED GENERATION SYSTEM

Attorney Docket: GP-303576

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APPELLANT'S THIRD APPEAL BRIEF

This is Appellant's Third Appeal Brief filed in accordance with 37 CFR § 41.37 appealing the Examiner's Office Action mailed March 22, 2010 that reopened prosecution in response to Appellant's Second Appeal Brief filed December 08, 2009. Appellant's Third Notice of Appeal, pursuant to 37 CFR § 41.31, is being filed concurrently herewith. It is believed that no fees are due for the Appeal Brief and the Notice of Appeal.

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I. Real Party in Interest

The real party in interest for this appeal is the General Motors Corporation of Detroit, Michigan, the assignee of this application.

II. Related Appeals and Interferences

There are no related appeals, interferences or judicial proceedings that will directly affect or be directly affected by the Board's decision in this appeal.

III. Status of the Claims

Claims 1-22 are pending. Claims 16-22 have been withdrawn from consideration as being directed to a non-elected invention. Claims 1-15 are on appeal. Claims 1-15 stand rejected. No claim has been allowed. No claim has been objected to. No claim has been cancelled.

IV. Status of Amendments

No amendments have been made in this application.

V. Summary of Claimed Subject Matter

The following is a concise explanation of the subject matter involved in the appeal, as required by 37 C.F.R. § 41.37(c)(1)(v). The following explanation is not intended to be used to construe the claims, which speak for themselves, nor do Appellants intend the following explanation to modify or add any claim elements, or to constitute a disclaimer of any equivalents to which the claims would otherwise be entitled, nor is any reference to certain preferred embodiments herein intended to disclaim other possible embodiments.

The following summary indicates certain portions of the specification (including the drawings) that provide examples of embodiments of elements of the claimed subject matter. It is to be understood that other portions of the specification not cited herein may also provide examples of embodiments of elements of the claimed subject matter. It is also to be understood that the indicated examples are merely examples, and the scope of the claimed subject matter includes alternative embodiments and equivalents thereof. References herein to the specification are thus intended to be exemplary and not limiting.

Independent claim 1 claims a fuel cell distribution system for controlling power being applied to a system load, such as fuel cell distribution generation system 40 including system loads 50 shown in figure 2. The system 40 includes a fuel cell module 42 with a fuel cell that generates a draw current and a power conditioning module 44 responsive to the draw current, see paragraph [0022], page 6, line 22 – page 7, line 2. The power conditioning module 44 conditions the draw current and applies the conditioned draw current to the system loads 50, see paragraph [0023], page 7, lines 3-8.

The system 40 also includes a fuel cell sensor 54 that measures the draw current from the fuel cell module 42 and provides the measured draw current to a fuel cell controller 56, see paragraph [0024], page 7, lines 9 – 13. The fuel cell controller 56 operates a load following algorithm that provides a command signal applied to the fuel cell module 42 that sets the available output power from the fuel cell module 42, see page 7, lines 15 – 17 and paragraph [0024]. The load following algorithm defines a maximum draw current signal applied to the power conditioning module 44 that defines a maximum draw current to be drawn from the fuel cell module 42, see paragraph [0025], page 7, lines 20-26.

Independent claim 13 claims a fuel cell distribution system for controlling power being applied to a system load, such as fuel cell distribution generation system 40 including system loads 50 shown in figure 2. The system 40 includes a fuel cell module 42 with a fuel cell and a battery that generates a draw current and a power conditioning module 44 responsive to the draw current and a battery current, see paragraph [0022], page 6, line 22 – page 7, line 2. The power conditioning module 44 conditions the draw current and the battery current and applies the conditioned draw current and battery current to the system loads 50, see paragraph [0023], page 7, lines 3-8.

The system 40 also includes a fuel cell sensor 54 that measures the draw current from the fuel cell module 42 and provides the measured draw current to a fuel cell controller 56, see paragraph [0024], page 7, lines 9 – 13. The fuel cell controller 56 operates a load following algorithm that provides a command signal applied to the fuel cell module 42 that sets the available output power from the fuel cell module 42, see page 7, lines 15 – 17 and paragraph [0024]. The load following algorithm defines a maximum draw current signal applied to the power conditioning module 44 that defines a maximum draw current to be drawn from the fuel cell module 42, see paragraph [0025], page 7, lines 20-26.

The load following algorithm also defines an approach threshold region, shown in figure 3 between graph lines 66 and 68, where graph line 66 represents the maximum current available from the fuel cell module 42, see paragraphs [0026] and [0027], page 7, line 28 – page 8, line 5. The fuel cell controller 56 increases the available output power from the fuel cell module 42 by a command signal on line 58 if the drawn current measured by the current sensor 54 enters the approach threshold region and the load following

algorithm maintains the available output power from the fuel cell module 42 constant by the command signal on the line 58 if the draw current measured by the current sensor 54 goes above the approach threshold region, see paragraph [0024], page 7, lines 16 – 21 and paragraph [0027], page 8, lines 4-18.

The load following algorithm also defines a diverge threshold region between the graph lines 68 and 70 shown in figure 3, see paragraph [0028], page 8, lines 19-21. The fuel cell module 42 decreases the available output power from the fuel cell module 42 by the command signal on the line 58 if the draw current measured by the current sensor 54 enters the diverge threshold region, and the load following algorithm maintains the available output power constant by the command signal on the line 58 if the draw current measured by the current sensor 54 leaves the diverge threshold, see paragraph [0028], page 8, lines 19-29.

The approach threshold and diverge threshold regions defined by the load following algorithm determine how the fuel cell module 42 is operated with respect to the draw current from the current sensor 54. If the current being drawn is much less than the maximum draw current, then hydrogen utilization is low. However, if the draw current is close to the maximum draw current, it is possible due to measurement error that the current is actually greater than the maximum draw current and can damage the fuel cell module 42, see paragraph [0029], page 8, line 30 – page 9, line 4.

VI. Grounds of Rejection to be Reviewed on Appeal

Whether claims 1-15 should be rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the enablement requirement;

Whether claims 7 and 14 should be rejected under 35 U.S.C. §112, second paragraph, as being indefinite;

Whether claims 1-5 and 10-13 should be rejected under 35 U.S.C. §102(b) as being anticipated by, or in the alternative, under 35 U.S.C. §103(a) as being unpatentable over United States Patent Application Publication No. 2001/004903 to Dickman (hereinafter "Dickman");

Whether claims 1-5 and 10-13 should be rejected under 35 U.S.C. §102(b) as being anticipated by, or in the alternative, under 35 U.S.C. §103(a) as being obvious over United States Patent Application Publication No. 2002/0082785 to Jones (hereinafter "Jones");

Whether claims 1-5 and 10-13 should be rejected under 35 U.S.C. §103(a) as being unpatentable over Jones in view of U.S. Patent No. 5,637,414 issued to Inoue et al. (hereinafter "Inoue");

Whether claims 6-9, 14 and 15 should be rejected under 35 U.S.C. §103(a) as being unpatentable over Dickman in view of Jung, Power Control Strategy for Fuel Cell Hybrid Electric Vehicles, Fuel Cell Power for Transportation, SP-1741, 2003 (hereinafter "Jung");

Whether claims 6-9, 14 and 15 should be rejected under 35 U.S.C. §103(a) as being unpatentable over Jones in view of Inoue and Jung;

Whether claims 6-9, 14 and 15 should be rejected under 35 U.S.C. §103(a) as being unpatentable over Dickman in view of U.S. Patent No. 4,839,574 issued to Takabayashi (hereinafter "Takabayashi"); and

Whether claims 6-9, 14 and 15 should be rejected under 35 U.S.C. §103(a) as being unpatentable over Jones in view of Takabayashi.

VII. Argument

A. Claims 1-15 comply with the enablement requirement

1. Enablement

MPEP 2164.01 states, "Any analysis of whether a particular claim is supported by the disclosure in an application requires a determination of whether that disclosure, when filed, contained sufficient information regarding the subject matter of the claims as to enable one skilled in the pertinent art to make and use the claimed invention." MPEP 2146.01 further states that the question to be asked when determining whether claims comply with the enablement requirement is as follows: is the experimentation needed to practice the invention undue or unreasonable? In addition, MPEP 2106 states, "USPTO personnel must always remember to use the perspective of one of ordinary skill in the art. Claims and disclosures are not to be evaluated in a vacuum. If elements of an invention are well known in the art, the applicant does not have to provide a disclosure that describes those elements."

2. Timeliness of rejection

In the Office Action mailed March 04, 2008, the Examiner did not make any §112 rejections. In the Final Office Action mailed December 05, 2008, the Examiner did not make any §112 rejections. In the Office Action mailed September 08, 2009, which reopened prosecution after the First Appeal Brief was filed, the Examiner did not make any §112 rejections. In the Office Action mailed March 22, 2010, after the Second Appeal Brief was filed, and more than two years after the first office action on the merits, the Examiner introduced a rejection under §112, first paragraph. Appellant respectfully submits that the §112, first paragraph, rejection is untimely and thus unreasonable for at least this reason.

However, Appellant has articulated the merits of the rejection below to ensure a complete response to the Office Action mailed March 22, 2010 is contained in this Third Appeal Brief.

3. Discussion

It is the Examiner's position, on pages 2 and 3 of the Office Action, that the limitations in claims 1-15 that are drawn to the power conditioning module, the controller and the load following algorithm are elements that are not described in a manner that enables one skilled in the art to make or use the invention.

With respect to the power conditioning module, the Examiner argues that it is unclear what elements receive signals from the controller and know how to draw current. Appellant respectfully directs the Board's attention to paragraphs [0022] – [0025] of the specification, which discuss figure 2. Figure 2 is a schematic block diagram illustrating the interrelationships between the components of the invention. In particular, paragraph [0025] states, "The current controller 56 also provides a current draw signal I_draw to the power conditioning module 44 on line 60. . .thus, the power conditioning module 44 knows to only draw as much current from the fuel cell module 42 as the fuel cell module 42 is currently able to produce, and knows to take any further power demanded by the loads 50 from the battery." In addition, paragraph [0026] of the specification discusses figure 3, which is a graphical representation of how the load following algorithm controls the amount of fuel provided to the fuel cell module.

Appellant respectfully submits that the Examiner's arguments regarding the sufficiency of how the power conditioning module functions are without merit, as one possessing ordinary skill in the art at the time the invention was made would understand

how to make the invention work given Appellant's disclosure in at least paragraphs [0022] – [0025] of the specification.

On pages 3 and 4 of the Office Action, the Examiner questions what elements constitute the controller. More specificially, the Examiner questions how a new available output power relates to the approach and diverge thresholds and how the load following algorithm is affected or involved. Paragraph [0027] of the specification discusses the approach threshold and paragraph [0028] of the specification discusses the diverge threshold. As discussed in paragraph [0027] of the specification, when the maximum drawn current I_maxFC increases, "[t]he approach threshold region is maintained constant, so that as the maximum drawn current I_maxFC increases, the AT graph line 68 increases." Thus, Appellant respectfully submits that one possessing ordinary skill in the art at the time the invention was made would understand how to implement the invention as claimed, because the interrelationship between a new available power output and the approach and diverge thresholds is clearly explained in the specification.

On page 4 of the Office Action, it is the Examiner's position that the graph in figure 3 "does not allow one of ordinary skill in the art to realize an intended algorithm or provide the steps required to translate the function into an algorithm for an unknown controlling component." Appellant respectfully submits that the unknown controlling component is controller 56. Evidence of this can be found in paragraph [0024], which states, "[t]he controller 56. . . provides a command I_reqFC to the fuel cell module on line 58 that instructs the fuel cell module 42 to generate a certain amount of power based on a load following algorithm discussed below." Furthermore, Appellant respectfully submits that one

having ordinary skill in the art would be capable of translating a function or set of functions into an algorithm, as that is the foundation of the art of software programming.

As discussed above, and described in at least paragraphs [0027] – [0029] of the specification, the maximum current draw will dictate the optimal approach threshold and diverge threshold. Thus, the Examiner's rationale on page 4 of the Office Action for finding a lack of enablement is without merit, as the Examiner is not considering the perspective of the skilled artisan, as the skilled artisan would readily appreciate that a maximum current draw for the specific fuel cell system used is what determines the approach threshold and the diverge threshold. Furthermore, as discussed *supra*, "Claims and disclosures are not to be evaluated in a vacuum. If elements of an invention are well known in the art, the applicant does not have to provide a disclosure that describes those elements." MPEP 2106.

In sum, Appellant respectfully submits that the Examiner has not established "on the record a <u>reasonable basis</u> for questioning the adequacy of the disclosure to enable a person of ordinary skill in the art to make and use the claimed invention without resorting to *undue experimentation*." (Emphasis in original). See MPEP 2161.01 III., *In re Brown*, 477 F.2d 946, 177 USPQ 691 (CCPA 1973) and *In re Ghiron*, 442 F.2d 985, 169 USPQ 723 (CCPA 1971). Therefore, Appellant respectfully requests that the enablement rejection under §112, first paragraph, be reversed.

B. Claims 7 and 14 are definite

1. Indefiniteness test

MPEP 2173.02 states, "[D]efiniteness of claim language must be analyzed, not in a vacuum, but in light of: (A) The content of the particular application disclosure; (B) The teachings of the prior art; and (C) The claim interpretation that would be given by one possessing the ordinary level of skill in the pertinent art at the time the invention was made."

2. Timeliness

In the first Office Action on the merits mailed March 04, 2008, the Examiner did not make any §112 rejections. In the Final Office Action mailed December 05, 2008, the Examiner did not make any §112 rejections. In the Office Action mailed September 08, 2009, which reopened prosecution after the First Appeal Brief was filed, the Examiner did not make any §112 rejections. In the Office Action mailed March 22, 2010, after the Second Appeal Brief was filed, and more than two years after the first Office Action on the merits, the Examiner introduced a rejection under §112, second paragraph. Appellant respectfully submits that the §112, second paragraph, rejection is untimely and thus unreasonable for at least this reason. However, Appellant has articulated the merits of the rejection below to ensure a complete response to the Office Action mailed March 22, 2010 is contained in this Third Appeal Brief.

3. Discussion

It is the Examiner's position, on page 5 of the Office Action, that claim 7 and 14 fail to particularly point out and distinctly claim the subject matter which Appellant regards as the invention because it is allegedly unclear as to how the function of increasing the

available output current if the battery sensor measures a predetermined battery current for a predetermined period of time fits in with the function of the algorithm. The Examiner, also on page 5 of the Office Action, goes on to state:

> Since the battery sensor is always measuring the battery current, then the battery current is always measuring a predetermined current for a predetermined period of time and <u>so the fuel cell controller is always increasing the available output of current</u>. So if the fuel cell's available output is always being increased, how does the fuel cell controller respond to the fuel cell signal and operate the load following algorithm? (Emphasis added).

Appellant is unclear as to the point the Examiner is trying to make, as the Examiner's conclusion that the fuel cell controller is always increasing the available output of current seems irrational. Claims 7 and 14 claim, *inter alia*, that the controller increases the available output power if the battery sensor measures a predetermined battery current continuously for a predetermined period of time. Put another way, if battery current maintains some value, the controller will signal that the amount of output power may be increased because the battery seems to be maintaining an optimal value, i.e., is not being depleted. One skilled in the art would readily perceive this, as any power generating device that is capable of always increasing available output seems unrealistic, even to a layperson.

Appellant respectfully submits that the Examiner has not based his §112, second paragraph, definiteness rejection on the content of the application disclosure, the teachings of the prior art or the claim interpretation that would be given by one of ordinary skill in the art. Therefore, Appellant respectfully requests that the §112, second paragraph, rejection be reversed.

C. Claims 1-5 and 10-13 are not anticipated by or made obvious by Dickman

1. Independent claims 1 and 13

Independent claim 1 claims a fuel cell distribution system for controlling power being applied to a system load that includes a fuel cell generating a draw current; a power conditioning module responsive to the draw current that conditions the draw current and applies the conditioned draw current to the system load; a fuel cell sensor that measures the draw current from the fuel cell; and a fuel cell controller that receives the measured draw current from the fuel cell sensor, where the fuel cell controller operates a load following algorithm that provides a command signal to the fuel cell that sets the available output power from the fuel cell where the load following algorithm also provides a maximum current draw signal to the power conditioning module that defines a maximum draw current to be drawn from the fuel cell.

Independent claim 13 claims a fuel cell distribution system for controlling power being applied to a system load that includes a fuel cell generating a draw current; a battery generating a battery current; a power conditioning module that conditions the draw current and the battery current and applies the conditioned current to the system load; a fuel cell sensor that measures the draw current from the fuel cell; and a fuel cell controller that receives the measured draw current and operates a load following algorithm that defines a command signal applied to the fuel cell and sets the available output power of the fuel cell, where the load following algorithm also defines a maximum draw current applied to the power conditioning module that defines a maximum draw current to be drawn from the fuel cell, defines an approach threshold region where the fuel cell controller increases the

available output power by the command signal if the draw current enters the approach threshold region and maintains the available output power constant by the command signal if the draw current leaves the approach threshold region, and also defines a diverge threshold region, where the fuel cell controller decreases the available output power by the command signal if the draw current enters the diverge threshold region and where the load following algorithm maintains the available output current constant by the command signal if the draw current leaves the diverge threshold region.

2. Dickman

Dickman discloses various embodiments of a fuel cell system 60 including a plurality of fuel cell stacks 76 that provide partial or total redundancy. Figure 5, as discussed in paragraph [0048], shows one embodiment of the system 60 that includes a power management module 81 through which electric power from the fuel cell stacks 76 is delivered to a load 80. A schematic diagram of the power management module 81 is shown in figure 6 and includes a DC-DC converter 93, a switching assembly 92, an inverter 85 and a battery assembly 86 including batteries 88 and a charger 90.

Figure 10 shows an embodiment of the fuel cell system 60 including a control system 120 having a controller 122, as discussed in paragraph [0057]. The controller 122 communicates with various components in the fuel cell system 60 through communication links 124. Inputs to the controller 122 include one or more current operating conditions, such as temperature, pressure, flow rate, composition, state of actuation, load, etc. Paragraph [0059] states that the control system 120 may be used to selectively isolate a stack from the applied load by sending a control signal to a corresponding contactor 100. Paragraph [0060] states that a DC-DC converter may isolate a stack if a minimum voltage

is not received. Paragraph [0061] states that the control system 120 may additionally or alternatively be used to selectively adjust or interrupt the flow of hydrogen gas, air and/or cooling fluid to one or more of the stacks 76. Paragraph [0063] states that the controller 122 may be adapted to select the stack to remove from service according to a predetermined sequence. Paragraph [0064] states that control system may include a user interface 130. Paragraph [0067] states that the control system 120 may be adapted to limit the magnitude of the peak load, or maximum desired power output, applied to the fuel cell stack assembly 77.

3. Discussion

MPEP 2131, quoting *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053, states, "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." Furthermore, MPEP 2114 states, "Even if the prior art device performs all the functions recited in the claim, the prior art cannot anticipate the claim if there is <u>any</u> structural difference." (Emphasis added).

MPEP 2141.02 I. states, "In determining the differences between the prior art and the claims, the question under 35 U.S.C. 103 is not whether the differences <u>themselves</u> would have been obvious, but whether the claimed invention <u>as a whole</u> would have been obvious." (Emphasis in original). *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 218 USPQ 871 (Fed. Cir. 1983); *Schenck v. Nortron Corp.*, 713 F.2d 782, 218 USPQ 698 (Fed. Cir. 1983).

It is the Examiner's position, on page 7 of the Office Action, that paragraphs [0046], [0048], [0049], [0057], [0060] and [0064] expressly or inherently disclose, or alternatively

teach or suggest, Appellant's independent claims 1 and 13. However, Appellant respectfully submits that the paragraphs of Dickman discussed above do not teach a fuel cell current sensor that measures the draw current of a fuel cell being sent to a power conditioning module as claimed by Appellant, where the measured current is sent to a fuel cell controller that then provides a command signal to the fuel cell using that measured current. Appellant's independent claims 1 and 13 claim, *inter alia*, that the controller uses a load following algorithm that sets the available output power <u>from the fuel cell</u>. In contrast, as acknowledged by the Examiner on page 7 of the Office Action, the controller of Dickman simply turns on or off fuel cells in the fuel cell stacks. Thus, Appellant respectfully submits that the controller of Dickman is clearly not utilizing a load following algorithm that is setting the available output power of <u>a fuel cell</u>.

Similarly, independent claim 13 further claims, *inter alia*, that the controller decreases the available output power of the fuel cell if the current draw enters a diverge threshold region. As discussed *supra*, the controller simply shuts fuel cells off in such a situation. Thus, Appellant respectfully submits that the Examiner has not shown how Dickman discloses or teaches Appellant's claimed invention, as the Examiner has not shown that Dickman utilizes a load following algorithm that defines a command signal applied to the fuel cell that sets the available output power from the fuel cell and also defines a maximum current draw signal applied to a power conditioning module that defines the maximum draw current to be drawn from a <u>fuel cell</u> as claimed by Appellant.

The Examiner states, on page 7 of the Office Action, that paragraphs [0034], [0035], [0040] and [0041] teach a controller that sets the available output power from the fuel cell and defines the maximum current drawn from the fuel cell through a power conditioning

module, however, the Examiner has not provided any discussion as to what element is the controller and what element is the power conditioning module in Dickman that operates in this manner. Presumably, the controller and the power conditioning module talked about in these paragraphs is the same controller and power conditioning module that the Examiner states exist in paragraphs [0046], [0048], [0049], [0057] and [0064]. Appellant can find no teaching in Dickman that suggests that the elements of Dickman are interconnected and function as Appellant's claimed invention, therefore, Appellant respectfully submits that Dickman does not anticipate or render Appellant's claimed invention obvious for at least this reason.

The Examiner also states, on page 7 of the Office Action, that, as the upper threshold of the available power for operating the fuel cell stacks is reached, the controller increases the available power by increasing the number of operating cells. Alternatively, if the power demand decreases below a threshold, then the available power is decreased by reducing the number of operating cells, citing paragraphs [0046], [0051] and [0067] of Dickman. Appellant submits that the Examiner has not articulated how these elements operation a load following algorithm that defines a command signal applied to the fuel cell that sets the available output power from the fuel cell and also defines a maximum current draw signal applied to a power conditioning module as claimed that defines the maximum draw current to be drawn from the fuel cell.

As stated by the Supreme Court, "A patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art." *KSR Int'l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1741 (2007). In addition, the Supreme Court goes on to state that the Examiner must "identify a reason that

would have prompted a person of ordinary skill in the art in the relevant field to combine the elements in the way the claimed new invention does." *Id.* Given the Examiner's limited articulation of the reasons for finding that Dickman anticipates or renders obvious Appellant's claimed invention, Appellant respectfully submits that a *prima facie* case of obviousness has not been proven. Thus, Appellant respectfully submits that, for this reason as well, the claimed invention is not anticipated by or obvious in view of Dickman.

Additonally, Appellant submits that Dickman does not teach other limitations that are contained in independent claim 13. For example, Dickman does not teach that the load following algorithm defines an approach threshold, where the fuel cell controller increases the available current output of the fuel cell by the command signal if the draw current enters the approach threshold. Dickman also does not teach that the load following algorithm maintains the available output power constant by the command signal if the draw current leaves the approach threshold, or that the load following algorithm defines a diverge threshold region, where the fuel cell controller decreases the available output power by the command signal if the draw current enters the diverge threshold region. Dickman further does not teach that the load following algorithm maintains the available output power constant by the command signal when the draw current leaves the diverge threshold.

Thus, for all of the reasons discussed above, Appellant respectfully submits that the claimed invention is not anticipated by or obvious in view of Dickman.

3. Dependent claims 10-12

Dependent claim 10 claims that the system provides power to a vehicle. Dependent claim 11 claims that the system is part of a vehicle control system that follows unmeasured loads in a vehicle. Dependent claim 12 claims that the unmeasured loads are from a

vehicle heating ventilation and air conditioning system. It is the Examiner's position, on page 7 of the Office Action, that claims 10-12 are not further limiting because they are drawn to intended use. Appellant respectfully reminds the Board of MPEP 2106 II.C., which states, "[L]anguage that suggests or makes optional but does not require steps to be performed or does not limit a claim to a particular structure does not limit the scope of a claim or claim limitation." (Emphasis in original). MPEP 2106 II.C. further states, "[U]SPTO personnel may not dissect a claimed invention into discrete elements and then evaluate the elements in isolation." Claims 10-12 positively recite additional elements, thus these additional limitations are not suggested or made optional. Thus, Appellant submits that the claimed subject matter are not intended use limitations as alleged by the Examiner.

D. Claims 1-5 and 10-13 are not anticipated by or obvious in view of Jones

1. Jones

Jones discloses a fuel cell system 10 that includes a technique for responding to up and down transients of the power output from a fuel cell stack. The Jones fuel cell system 10 includes a controller 60 that includes a voltage regulator 30 and an inverter 33 between a fuel cell stack 20 and a system load 50. Figure 3 is a graph showing the output power from the fuel cell stack 20. Paragraph [0030] talks about figure 3 and states that the graph shows a hysteresis zone 121 having an upper threshold 121a and a lower threshold 121b. As long as the power drawn by the load 50 is within the zone 121, the controller 60 determines that a transient has not occurred. If the power drawn by load 50 exceeds one of the thresholds 121a or 121b, the controller 60 recognizes that a transient has occurred. The main thrust of the Jones disclosure has to do with providing a delay in response to an

up or down transient so that the fuel and air provided to the fuel cell stack 20 is not immediately changed so that the system does not respond to temporary up or down transients, see paragraph [0032]. If a delay interval passes, then the controller 60 determines that additional or less fuel and air should be provided to accommodate the transient.

2. Discussion

MPEP 2131, quoting *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053, states, "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." Furthermore, MPEP 2114 states, "Even if the prior art device performs all the functions recited in the claim, the prior art cannot anticipate the claim if there is <u>any</u> structural difference." (Emphasis added).

MPEP 2141.02 I. states, "In determining the differences between the prior art and the claims, the question under 35 U.S.C. 103 is not whether the differences <u>themselves</u> would have been obvious, but whether the claimed invention <u>as a whole</u> would have been obvious." (Emphasis in original). *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 218 USPQ 871 (Fed. Cir. 1983); *Schenck v. Nortron Corp.*, 713 F.2d 782, 218 USPQ 698 (Fed. Cir. 1983).

Appellant respectfully submits that, *assuming arguendo* that the algorithm in Jones may be some type of load following algorithm, the Jones process for responding still does not render Appellant's claimed invention obvious because, *inter alia*, the Jones process does not provide a command signal applied to a fuel cell that sets the available output power from the fuel cell. Further, Jones does not define a maximum current that can be

drawn from the fuel cell, as the controller 60 in Jones is not even coupled to the voltage regulator 30 or the inverter 33.

On page 8 of the Office Action, the Examiner cites paragraphs [0029] and [0038] of Jones as teaching Appellant's claimed load following algorithm. Paragraphs [0029] and [0038] of Jones are recreated below:

> [0029] More specifically, referring to FIGS. 3 and 5, in some embodiments of the invention, the program 65, when executed by the controller 60, may cause the controller 60 to perform a technique 150 (depicted in FIG. 5) to control the fuel processor 22 in response to up and down transients. In particular, the controller 60 introduces (block 152 of FIG. 5) a first delay in response to an up transient. For example, the power that is demanded by the load 50 may initially reside near output power level called P_1 (see FIG. 3), and during the time interval from T_0 to T, the fuel processor 22 may operate at a steady state fuel output level called L_1 (see FIG. 4) to provide the appropriate fuel to sustain the power that is consumed by the load 50 at the P_1 level.
>
> [0038] FIG. 3 also depicts a momentary spike 120 in the power that is consumed by the load 50. The spike begins at time T_5 and lasts until time T_7. In response to the increase, the controller 60 introduces another delay interval 128 that beings at time T_5 and extends until time T_7. However, the delay interval 128 is shorter than the delay interval 125, as the controller 60 recognizes (at time T_7) that the increase in power has not been sustained and therefore, resets the delay and does not increase the fuel output of the fuel processor 22 to accommodate this increase.

Appellant respectfully submits that Jones is describing a system that selectively increases or decreases fuel, but does not teach a load following algorithm that defines a command signal applied to a fuel cell that sets the available output power from the fuel cell, or a load following algorithm that defines a maximum draw current to be drawn from the fuel cell. Thus, Jones cannot anticipate or render obvious Appellant's claimed invention.

It is the Examiner's position, on page 8 of the Office Action, that the maximum current draw and available output power are set by the number of fuel cells in the stack and

the available reactants flowing to the cells. The Examiner does not cite any language in Jones to support this conclusion. Appellant respectfully submits that Jones does not provide a command signal applied to a fuel cell that sets the available output power from the fuel cell, and does not define a maximum current draw signal applied to a power conditioning module that defines a maximum current that can be drawn. As discussed *supra*, the controller 60 in Jones is not even coupled to the voltage regulator 60 or the inverter 33.

As stated by the Supreme Court, "A patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art." *KSR Int'l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1741 (2007). In addition, the Supreme Court goes on to state that the Examiner must "identify a reason that would have prompted a person of ordinary skill in the art in the relevant field to combine the elements in the way the claimed new invention does." *Id.* Given the Examiner's limited articulation of the reasons for finding that Jones anticipates or renders obvious Appellant's claimed invention, Appellant respectfully submits that a *prima facie* case of obviousness has not been proven. Therefore, Appellant submits that the Examiner has not carried the burden of articulating which device in Jones can be considered to be Appellant's power conditioning module. Thus, for this reason as well, Appellant respectfully submits that Jones does not anticipate or render obvious the claimed invention.

3. Dependent claims 10-12

Dependent claim 10 claims that the system provides power to a vehicle. Dependent claim 11 claims that the system is part of a vehicle control system that follows unmeasured loads in a vehicle. Dependent claim 12 claims that the unmeasured loads are from a

vehicle heating ventilation and air conditioning system. It is the Examiner's position, on page 7 of the Office Action, that claims 10-12 are not further limiting because they are drawn to intended use. Appellant respectfully reminds the Board of MPEP 2106 II.C., which states, "[L]anguage that <u>suggests or makes optional</u> but does not require steps to be performed or does not limit a claim to a particular structure does not limit the scope of a claim or claim limitation." (Emphasis in original). MPEP 2106 II.C. further states, "[U]SPTO personnel may not dissect a claimed invention into discrete elements and then evaluate the elements in isolation." Claims 10-12 positively recite additional elements, thus these additional limitations are not suggested or made optional. Thus, Appellant submits that the claimed subject matter are not intended use limitations as alleged by the Examiner.

E. Claims 1-5 and 10-13 are not obvious in view of Jones and Inoue

1. Inoue

Inoue discloses a fuel cell power generator with an output controlling system for preventing the deterioration of fuel cell performance caused by fuel gas shortages. The output controlling system includes an output correction means 10, an output control regulator 5, a current command computing unit 6 and an inverter controller 7. The output correction means 10 includes a fuel gas flow rate detector 14, an available output computing unit 11, an output setting unit 4, a low level selector 12, a current detector 15 for the fuel cell 2, and an output correction regulator 13. Given the fuel gas flow rate, the available output computing unit 11 computes a current value corresponding to a maximum available output power that the fuel cell 2 can generate without suffering from a fuel gas shortage.

2. Discussion

As discussed *supra,* Appellant respectfully submits that the Jones process does not provide a command signal applied to a fuel cell that sets the available output power from the fuel cell, and does not define a maximum current draw signal applied to a power conditioning module that defines a maximum current that can be drawn from the fuel cell. The controller 60 in Jones is not even coupled to the voltage regulator 30 or the inverter 33. Thus, these or any other devices in the Jones system that can be considered a power conditioning module do not receive a signal defining a maximum current draw from the controller.

The Examiner has directed Appellant's attention to paragraphs [0029] - [0038] as teaching Appellant's claimed load following algorithm. As discussed *supra*, Appellant has carefully reviewed these paragraphs in Jones and can find no teaching therein that the controller 60 provides a command signal that is sent to the fuel cell stack 20 to set the available output power from the fuel cell stack 20 and a maximum current draw signal that defines a maximum current that can be drawn from the fuel cell stack 20 that is sent to a power conditioning module that conditions the output from the fuel cell stack to the load on the stack. Clearly, Jones does not teach or suggest the detailed operation of the load following algorithm in independent claim 13.

The Examiner states on page 9 of the Office Action that Jones is silent as to the controller setting a maximum draw current to the power conditioning module, which seems to contradict the anticipation/obviousness rejection above, and appears to rely on Inoue to provide this teaching. The Examiner states that, "the method of controlling the system

includes a controller that communicates with a power conditioning module to evaluate and set the maximum available power output for the fuel cell (abstract). A command signal from the controller to the power conditioning module sets the maximum available draw current that can be drawn from the fuel cell (fig.1; 2:25-3:5, 4:35-5:45)."

Appellant respectfully submits that these sections of the Summary of the Invention section of Inoue do not teach a controller in communication with a power conditioning module that sets the maximum power output of a fuel cell and the maximum available draw current from the fuel cell, and the Examiner has not specifically identified where these elements are in these sections of Inoue. Further, Appellant submits that Inoue does not provide the teaching missing from Jones to make Appellant's claimed invention obvious concerning any of a power conditioning module that conditions a draw current from a fuel cell and applies a conditioned draw current to a system load or a fuel cell controller that operates a load following algorithm that identifies a command signal applied to a fuel cell that sets the available output power for the fuel cell and the maximum current drawn from the fuel cell. Further, Inoue clearly does not teach or suggest the approach and diverge threshold regions specifically claimed in independent claim 13, and the Examiner has not provided any discussion as to where these elements of the claims may exist in Inoue.

While Inoue discloses a system for preventing the deterioration of fuel cell performance caused by fuel gas shortages that includes monitoring fuel gas flow rate and calculating the maximum available output power <u>based on the fuel gas available</u>, Appellant respectfully submits that Inoue does not teach or suggest a power conditioning module responsive to a system load. Thus, while Inoue teaches a system for monitoring the flow rate of a fuel gas that includes preventing a fuel cell system from trying to generate more

power than the fuel supply can support, Appellant respectfully submits that this system does not render obvious Appellant's claimed invention that utilizes a power conditioning module that prevents a load from drawing more power than a fuel cell stack can safely supply. In particular, Inoue does not teach a power conditioning module that conditions the current draw to prevent a load from drawing more current than the fuel cell can provide, where a fuel cell controller operates utilizing a load following algorithm that defines a maximum current that can be drawn from the fuel cell. Therefore, Inoue does not provide the teaching missing from Jones that is necessary to render Appellant's claimed invention obvious.

In addition, Inoue also fails to teach or suggest the detailed operation of the load following algorithm in independent claim 13, as Inoue fails to teach, *inter alia*, a power conditioning module that conditions the battery current and that applies the conditioned battery current to the system load. Therefore, Appellant's claimed invention cannot be rendered obvious by the combination of Jones and Inoue.

F. Claims 6-9, 14 and 15 are not obvious in view of Dickman and Jung

1. Jung

Jung discloses a power control strategy for fuel cell hybrid electric vehicles, including a state of charge (SOC) controller for controlling a bi-directional DC/DC converter to supply power to maintain the desired SOC of a battery. Battery power may be controlled by the SOC controller by regulating the output current of the battery according to its output voltage, or by a voltage control method with a DC/DC converter.

2. Discussion

As discussed *supra*, the power management module 81 of Dickman does not include a module that applies a conditioned current to a load, a current meter for measuring and reporting the fuel cells current and a fuel cell controller. Further, and as also discussed *supra*, the Examiner has failed to define how the operations of Appellant's claimed invention are performed by Dickman.

The Examiner states on page 10 of the Office Action that Jung teaches a method of controlling a fuel cell and battery system for a vehicle including a controller that controls power distribution and uses power from the fuel cell to recharge the battery 1 required, citing page 1, paragraphs 4 and 5, page 3, paragraphs 1 and 5 and figure 3, and a state of charge controller that monitors either the voltage or the current of the battery, citing figures 5 and 7 and page 3, paragraphs 2-5.

Claims 6-9, 14 and 15 include a battery current sensor that measures battery current, a battery voltage sensor that measures battery voltage, a fuel cell controller responsive to a battery current signal from the battery current sensor and a battery voltage signal from the battery voltage sensor, where the fuel cell controller increases the available output power if the battery sensor measures a battery current continuously for a predetermined period of time, monitors battery voltage drift and determines a charge current applied to the battery by increasing the power generated by the fuel cell. Appellant respectfully submits that the sections identified by the Examiner in Jung do not teach a battery current sensor or a battery voltage sensor, and do not teach a battery current sensor, a battery voltage sensor and a fuel cell controller that operate in the manner as

claimed, and the Examiner has not specifically identified where those elements in the Jung system exist.

G. Claims 6-9, 14 and 15 are not obvious in view of Jones, Inoue and Jung

As discussed *supra*, Jones and Inoue fail to teach or suggest Appellant's claimed invention. In addition, Jung fails to provide the teachings missing from Jones and Inoue as discussed above. In particular, Jung fails to teach, *inter alia*, a command signal applied to a fuel cell that sets the output power from the fuel cell, and does not define a maximum current draw signal applied to a power conditioning module in response to a load that defines a maximum current that can be drawn from the fuel cell. Thus, the combination of Jones, Inoue and Jung does not render the claimed invention obvious.

H. Claims 6-9, 14 and 15 are not obvious in view of Dickman and Takabayashi

1. Takabayashi

Takabayashi discloses a generator system including a fuel cell 4 and a fuel cell current detector 7 for detecting the electric current supplied from the fuel cell 4 to a battery 8 and a load 9. A detector 10 detects DC current flowing into the battery 8 to detect charging and discharging currents of the battery 8.

2. Discussion

The Examiner states on page 13 of the Office Action that Takabayashi teaches that the power output of a fuel cell is increased in response to battery voltage or current measurements, citing the Abstract and column 1, line 65-column 2, line 15, that the

controller measures and monitors the battery current and when a predetermined battery current is measured for a predetermined period of time, the fuel cell power output is increased, citing figures 1 and 2, column 3, lines 45-60 and column 4, lines 25-50, and so forth.

Appellant has reviewed these sections of Takabayashi and can find no specific teaching therein of a battery current sensor, a battery voltage sensor and a fuel cell controller as defined in dependent claims 6-9, 14 and 15, and the Examiner has not specifically identified where these elements of the claimed invention exist. Therefore, Appellant submits that Takabayashi does not provide the teaching missing from Dickman to make these claims obvious.

I. Claims 6-9, 14 and 15 are not obvious in view of Jones and Takabayashi

As discussed above, Takabayashi fails to provide the teaching to make dependent claims 6-9, 14 and 15 obvious, and therefore cannot be combined with Jones to make Applicant's claimed invention obvious.

VIII. Conclusion

Appellant respectfully submits that claims 1-15 comply with the enablement requirement, claims 7 and 14 are definite, claims 1-5 and 10-13 are not anticipated or made obvious by Dickman, claims 1-5 and 10-13 are not anticipated by or obvious in view of Jones, claims 1-5 and 10-13 are not obvious in view of Jones and Inoue, claims 6-9, 14 and 15 are not obvious in view of Dickman and Jung, claims 6-9, 14 and 15 are not obvious in view of Jones, Inoue and Jung, claims 6-9, 14 and 15 are not obvious in view of Dickman and Takabayashi, and claims 6-9, 14 and 15 are not obvious in view of Jones and Takabayashi. It is therefore respectfully requested that the Examiner's rejections be reversed, and Appellant's claims be allowed.

Respectfully submitted,
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CLAIMS APPENDIX

COPY OF CLAIMS INVOLVED IN THE APPEAL

1. (Original) A fuel cell distribution system for controlling power being applied to a system load, said system comprising:

a fuel cell, said fuel cell generating a draw current;

a power conditioning module responsive to the draw current, said power conditioning module conditioning the draw current and applying the conditioned draw current to the system load;

a fuel cell sensor, said fuel cell sensor measuring the draw current from the fuel cell and generating a fuel cell signal indicative of the measured draw current; and

a fuel cell controller responsive to the fuel cell signal, said fuel cell controller operating a load following algorithm that defines a command signal applied to the fuel cell that sets the available output power from the fuel cell, said load following algorithm also defining a maximum current draw signal applied to the power conditioning module that defines a maximum draw current to be drawn from the fuel cell.

2. (Original) The system according to claim 1 wherein the load following algorithm defines an approach threshold region, and wherein the fuel cell controller increases the available output power by the command signal if the draw current enters the approach threshold region.

3. (Original) The system according to claim 2 wherein the load following algorithm maintains the available output power constant by the command signal if the draw current leaves the approach threshold region.

4. (Original) The system according to claim 1 wherein the load following algorithm defines a diverge threshold region, and wherein the fuel cell controller decreases the available output power by the command signal if the draw current enters the diverge threshold region.

5. (Original) The system according to claim 4 wherein the load following algorithm maintains the available output power constant by the command signal if the draw current leaves the diverge threshold region.

6. (Original) The system according to claim 1 further comprising a battery and a battery current sensor, said battery providing battery current for the system load and said battery current sensor measuring the battery current, said battery current sensor generating a battery current signal indicative of the measured battery current.

7. (Original) The system according to claim 6 wherein the fuel cell controller is responsive to the battery current signal, said fuel cell controller increasing the available output power if the battery sensor measures a predetermined battery current continuously for a predetermined period of time.

8. (Original) The system according to claim 1 further comprising a battery and a battery voltage sensor, said battery providing battery voltage for the system load and said battery voltage sensor measuring the battery voltage, said battery voltage sensor generating a battery voltage signal indicative of the measured battery voltage.

9. (Original) The system according to claim 8 wherein the fuel cell controller is responsive to the battery voltage signal, said fuel cell controller monitoring battery voltage drift and determining a charge current applied to the battery by increasing the power generated by the fuel cell.

10. (Original) The system according to claim 1 wherein the system provides power to a vehicle.

11. (Original) The system according to claim 1 wherein the system is part of a vehicle control system that follows unmeasured loads in a vehicle.

12. (Original) The system according to claim 11 wherein the unmeasured loads are from a vehicle heating ventilation and air conditioning system.

13. (Original) A fuel cell distribution system for controlling power being applied to a system load, said system comprising:

a fuel cell, said fuel cell generating a draw current;

a battery, said battery generating a battery current;

a power conditioning module responsive to the draw current and the battery current, said power conditioning module conditioning the draw current and the battery current and applying the conditioned draw current and battery current to the system load;

a fuel cell sensor, said fuel cell sensor measuring the draw current from the fuel cell and generating a fuel cell signal indicative of the measured draw current; and

a fuel cell controller responsive to the fuel cell signal, said fuel cell controller operating a load following algorithm that defines a command signal applied to the fuel cell that sets the available output power from the fuel cell, said load following algorithm also defining a maximum draw current signal applied to the power conditioning module that defines a maximum draw current to be drawn from the fuel cell, said load following algorithm defining an approach threshold region, wherein the fuel cell controller increases the available output power by the command signal if the draw current enters the approach threshold region, and wherein the load following algorithm maintains the available output power constant by the command signal if the draw current leaves the approach threshold region, said load following algorithm also defining a diverge threshold region, wherein the fuel cell controller decreases the available output power by the command signal if the draw current enters the diverge threshold region, and wherein the load following algorithm maintains the available output power constant by the command signal if the draw current leaves the diverge threshold region.

14. (Original) The system according to claim 13 further comprising a battery current sensor, said battery current sensor measuring the battery current, said battery current sensor generating a battery current signal indicative of the measured battery

current, wherein the fuel cell controller is responsive to the battery current signal, said fuel cell controller increasing the available output power if the battery sensor measures a predetermined battery current continuously for a predetermined period of time.

15. (Original) The system according to claim 13 further comprising a battery voltage sensor, said battery voltage sensor measuring the battery voltage, said battery voltage sensor generating a battery voltage signal indicative of the measured battery voltage, wherein the fuel cell controller is responsive to the battery voltage signal, said fuel cell controller monitoring battery voltage drift and controlling a charge current applied to the battery.

EVIDENCE APPENDIX

There is no evidence pursuant to §1.130, §1.131 or §1.132.

RELATED PROCEEDINGS APPENDIX

There are no decisions rendered by a court or the Board in any proceeding identified in Section II of this Appeal Brief.